Implementation Guidance for Ambient Water Quality Criteria for Bacteria

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Synopsis for E. coli Rulemaking

Roseann Hirschinger
OWQ/AB/Surveys Section

The following document contains excerpts from a 101-page document. The complete document can be viewed at http://www.epa.gov/waterscience/standards/bacteria/bacteria.pdf.

Note 1. EPA OST Contact Elizabeth Southerland (202) 566-0400 or Geoffery Grubbs (202) 566-0430 USEPA—OST

Executive Summary

The purpose of this document is to provide guidance for the implementation of water quality criteria for bacteria once adopted into state water quality standards. As part of these recommendations, EPA is encouraging states to use *E. coli* or enterococci as the basis of their water quality criteria for bacteria to protect fresh recreational waters. Further, for coastal recreational waters (i.e., marine waters, coastal estuaries, and the Great Lakes), states are required to adopt bacteriological criteria as protective as EPA's Clean Water Act §304(a) criteria recommendations by April 2004. EPA believes the use of *E. coli* and/or enterococci are best suited to prevent acute gastrointestinal illness caused by the incidental ingestion of fecally contaminated recreational waterbodies.

This document provides a summary of EPA's existing recommended water quality criteria for bacteria that it published in 1986 as well as recommendations on the implementation of bacteriological criteria for the protection of recreation uses once they have been adopted into a state water quality standards. The use of water quality standards to protect recreational waters encompasses a broad spectrum of waterbody types, from heavily used ocean front beach areas, to remote mountain streams. This document attempts to acknowledge these different types of recreational uses and the different management choices that are available to states in managing these water resources.

States must adopt primary contact recreation wherever attainable for all surface waters within their jurisdiction, and, in doing so, consider the use of the waterbody by children and other susceptible groups. To provide protection of human health, states and s should conduct sanitary surveys to identify sources of fecal pollution when high levels of bacteria are observed.

In many circumstances, waterbodies are impacted by not only human sources of fecal contamination, but also other animals, including wildlife. In these situations, based on ability of warm-blooded animals to harbor and shed human pathogens, EPA feels it is inappropriate to conclude that these sources present no risk to human health from waterborne pathogens. Consequently, states should not use broad exemptions from the bacteriological criteria for waters designated for primary contact recreation based on the presumption that high levels of bacteria resulting from non-human fecal contamination present no risk to human health. This policy

statement revises EPA's previous policy as stated in its 1994 *Water Quality Standards Handbook*, which allowed states to justify a decision not to apply the bacteriological criteria to particular recreational waters when high concentrations of bacteria were found to be of animal origin.

For heavily-used beach areas and other well-known or popular recreational areas, EPA recommends a more conservative approach in the adoption and implementation of recreational water quality standards, such as adoption of criteria based on lower illness rates, consideration of the use of the 75% confidence level as a single sample maximum value, frequent monitoring, and the use of sanitary surveys to identify sources of fecal pollution.

For other types of waterbodies, states may opt to use different approaches in the management of their recreational waterbodies. For example, those states wishing to adopt bacteriological criteria based on the same illness rates for their fresh and marine waters may adopt both fresh and marine water criteria based on illness rates no greater than 14 illnesses per 1000 swimmers. For states not opting for this approach, the maximum illness rate upon which fresh water criteria should be based is 14 illnesses per 1000 swimmers and the maximum illness rate upon which marine water criteria should be based is 19 illnesses per 1000 swimmers.

In some instances, particularly in northern climates, states may choose to adopt seasonal recreation uses to protect primary contact recreation during the time of year it occurs and to prevent excessive disinfection by dischargers during the winter months. Residual chlorine in effluents can result in the formation of disinfection by-products, such as trihalomethanes in surface waters, which can have an adverse effect on human health and aquatic life. In other circumstances where a state has determined that primary contact recreation is not an existing use as defined by federal and state (or tribal) regulations, nor attainable for one of the reasons identified in the federal and state (or tribal) regulations, states may adopt other categories of recreation such as intermittent primary contact recreation, wildlife impacted recreation, or secondary contact recreation.

In addition to providing recommendations on the adoption of recreational uses and protective water quality criteria into water quality standards, the document also provides explanations of how states' recreational water quality standards should be used to form the basis for water quality-based National Pollutant Discharge Elimination System permits, assess and determine attainment of water quality standards, and develop subsequent Total Maximum Daily Loads and wasteload allocations.

While this document is focused primarily on the adoption and implementation of water quality criteria for bacteria as part of a states' or s' recreational water quality standards, there are some natural relationships between this topic and drinking water programs, shellfishing programs, and beach management activities. These documents provide brief discussions of these relationships and, where appropriate, provide the reader with references where more information may be obtained. (This **section, complete text, pp v-vi)**

Table of Contents **bolded sections are covered in this Document, Page no's are from Adobe file.**

Section 1 contains **background and introduction** to the topics of waterborne disease and different types of pathogens. This part and the explanation of the necessity of the Guidance to meet mandates of the BEACH Act amendments to the CWA **are not included**

Section 2 contains a reaffirmation of the scientific validity of the *Ambient Water Quality Criteria for Bacteria*–1986 through **a summarization EPA's review of relevant** peer-reviewed **epidemiological studies** conducted since EPA's 1984 epidemiological studies;

Section 3 contains an explanation of **the relationship among state** and tribal **water quality standards,** the requirements of the **BEACH Act amendments**, and state and tribal **beach monitoring and advisory programs**. (Please note- the phrase "and Tribal" has been excerpt from this synopsis.)

Sections 4.2 and 4.4 contain recommendations on the application of EPA's recommended water quality criteria to **waters contaminated by non-human sources.**

Section 4.3 provides recommendations for appropriate approaches for monitoring the safety of recreational waters in those **tropical climates** where *E. coli* and enterococci may exist naturally in the soil environment, possibly complicating the use of those organisms as indicators; **This section is not included here**.

Sections 4.4 and 4.5 provide recommendations for appropriate approaches for managing **risk in waters that are not designated for primary contact recreation,** including waters impacted by wildlife sources of fecal pollution or high levels of indicator organisms during wet weather events. **Indiana has no water designated as less than Primary Contact, the default status under CWA.**

Section 5.1 contains recommendations for making the transition from fecal coliforms to EPA's recommended water quality criteria, including the use of multiple indicators during a transition period. **Indiana has made this transition, so 5.1 and 5.2and 5.2.1 are not included.**

Sections 5.2.2 and 5.2.3 addresses **permits and anti-backsliding**.
Section 5.4 contains **recommendations on** the development of wasteload allocations for the purpose of calculating **Total Maximum Daily Loads; This is not included**.

Section 5.5 provides recommendations for the use of detection and enumeration methods in monitoring ambient and effluent water quality; and

Sections 5.6 and 5.7 discuss the relationship of recommendations contained in this document to **the protection of drinking water sources. I have not included shell-fishing protection.**

1.4 What are EPA's recommended water quality criteria for bacteria?

When EPA published its criteria in 1986**, illness rates were established based on 8 illnesses per 1000 swimmers in fresh waters** and 19 illnesses per 1000 in marine waters, an approximation of the protection previously afforded by the fecal coliform criterion. In this guidance EPA has determined that a state may elect to choose criteria associated with other illness rates to apply equally to both its fresh and marine recreational waters. While, in theory, states could adopt criteria for both fresh and marine recreational waters associated with illness rates of up to 19 illnesses per 1000 swimmers to protect its waters designated for primary contact recreation, states should be aware that the epidemiological data used to support the relationship between illness rates and fresh water bacteriological conditions is based on an observed illness rate range of up to 14 illnesses per 1000 swimmers, and thus, does not support extrapolation beyond that point. Consequently, EPA recommends that for states choosing to adopt fresh and marine water criteria based on approximately the same illness rates, **the criteria be based on illness rates below 14 illnesses per 1000 swimmers**. Further discussion on this topic is contained in section 4.1.1.7

1.5.2 How were the data from EPA's epidemiological studies analyzed to provide EPA's recommended water quality criteria for bacteria?

EPA recognizes that the single sample maximum values in the 1986 criteria document are described as "upper confidence levels," however, the statistical equations used to calculate these values were those used to calculate percentile values. While the resultant maximum values would more appropriately be called 75$_{th}$ percentile values, 82$_{nd}$ percentile values, etc., this document will continue to use the historical term "confidence levels" to describe these values to avoid confusion. As displayed in Appendix D tables, confidence levels were chosen ranging from 75% to 95% and assigned subjective, qualitative descriptions. For example, the most conservative single sample maximum value was assigned to beach areas because a more conservative approach should be taken in the protection of heavily used recreational waterbodies. Conceivably, less intensively used areas may have the less restrictive single sample limits applied to them. EPA recommends the use of the single sample maximum value associated with a 75$_{th}$ percentile for beach areas as a more conservative approach to assuring that the associated geometric mean is not exceeded in those areas regularly used for primary contact recreation activities.

The criteria were developed based on exposures incurred during swimming with head immersion and are thus intended to be adopted by states to protect their primary contact recreation uses. Other criteria values may be used to protect surface **waters that are not designated for primary contact recreation**; however, such a designation must be supported by a use attainability analysis consistent with federal regulations at 40 CFR 131.10(g). See sections 4.4 and 4.5 for further discussion.

2. Reaffirmation of EPA's Recommended Water Quality Criteria

2.1 Does EPA continue to support its *Ambient Water Quality Criteria for Bacteria* – 1986?

In addition to its re-evaluation of the original studies, EPA reviewed the literature for epidemiological research studies conducted after EPA performed its marine and freshwater studies of swimming-associated health effects. The review examined recent studies to determine if EPA's indicator relationship findings were supported or if different indicator bacteria were consistently

shown to have quantitatively better predictive abilities. EPA's Office of Research and Development reviewed 11 separate peer-reviewed studies. This detailed review is contained in Appendix B. Following this review, EPA's Office of Research and Development concluded:

"The epidemiological studies conducted since 1984, which examined the relationships between water quality and swimming-associated health effects, have not established any new or unique principles that might significantly affect the current guidance EPA recommends for maintaining the microbiological safety of marine and freshwater bathing beaches. Many of the studies have, in fact, confirmed and validated the findings of the U.S. EPA studies. There would appear to be no good reason for modifying the Agency's current guidance for recreational waters at this time. " (Dufour, 1999).

As a result of this examination, EPA believes its 1986 water quality criteria for bacteria continue to represent the best available science and serve as a defensible foundation for protecting public health in recreational waters. EPA has no new scientific information or data justifying a revision of the Agency's recommended 1986 water quality criteria for bacteria at this time. EPA continues to believe that when appropriately applied and implemented, EPA's recommended *Ambient Water Quality Criteria for Bacteria*–1986 are protective of human health for acute gastrointestinal illness.

Table 2.1 Summary of Research Conducted Since 1984, Fresh water studies only

Researcher	Year	Location	Type of Water	Microorganisms Evaluated	Relevant Findings
Seyfried et al.	1985	Canada	Fresh	Fecal coliforms Fecal streptococci Heterotrophic bacteria *Pseudomonas Aeruginosa,* Total staphylococci	Small degree of correlation observed between Fecal streptococci and gastrointestinal illness. Best correlation was between gastrointestinal illness and staphylococcus densities.
Ferley et al.[12]	1989	France	Fresh	Fecal coliforms, Fecal streptococci *Pseudomonas aeruginosa*	In this study, the definition of fecal streptococci is essentially the same as the U.S. definition of enterococci. Good relationship between swimming associatedillness and fecal coliform and fecal streptococci concentrations. Strongest relationship was between gastrointestinal disease and fecal streptococci densities.

References

11. Seyfried, P.L., R.S. Tobin, N.E. Brown, and P.F. Ness. 1985. A prospective study of swimming-related illness II. Morbidity and the Microbiological Quality of Water. Am. J. Public Health 75:1071-1075.

12. Ferley, J.P., D. Zmirou, F. Balducci, B. Baleux, P. Fera, G. Larbaigt, E. Jacq, B. Moissonnier, A. Blineau, and J. Boudot. 1989. Epidemiological significance of microbiological pollution criteria for river recreational waters. Int. J. of Epidemiol. 18:198-205.

3. Relationship Between Water Quality Standards and Beach Monitoring and Advisory Programs

CWA §303 requires states to adopt water quality standards for waters of the United States within their jurisdiction sufficient to "protect the public health or welfare, enhance the quality of water and serve the purposes of [the CWA]." EPA has an oversight role in this process. EPA's implementing regulations at 40 CFR 131.11 require water quality criteria to be based on sound scientific rationale and to contain sufficient parameters to protect designated uses. Section 303(c) specifies that water quality standards shall include the designated use or uses to be made of the water and water quality criteria necessary to protect those uses.

Once adopted by a state into their water quality standards, the water quality criteria are used to establish National Pollutant Discharge Elimination System (NPDES) water quality-based permit limits, to assess the attainment of water quality, and to provide the basis upon which Total Maximum Daily Loads (TMDLs) are developed.

In addition to the uses for the state-adopted water quality criteria for bacteria listed above, EPA recommends beach programs use the state-adopted water quality standards for beach advisories (a requirement for those beaches covered under the BEACH Act) and encourages coordination between state water quality standards programs and beach monitoring and advisory programs.

In general, waters designated for primary contact recreation within a state water quality standards comprise a much larger group of waterbodies than those falling under the purview of a state beach program. While waters designated for primary contact recreation may consist of a majority of a state waters and may vary in type from remote streams to well-known and highly managed beach areas, beach programs generally focus on the latter subset.

Although these natural relationships exist between water quality standards and beach monitoring and advisory programs, the use of bacterial water quality monitoring data as part of beach monitoring and advisory programs may differ slightly to account for some of the inherent differences between the two programs. For example, because a beach manager must make decisions based on water quality on a given day or weekend, he, or she may focus more on recently collected data to determine whether a swimming advisory should be issued. Further, for beach programs, beach managers may wish to consider other types of data in addition to water quality data. This may include the consideration of rainfall data when notifying the public that the standards have been exceeded or are expected to be exceeded. EPA understands that the authority for administering beach programs varies among states and s and may rest with state, tribal, county, or municipal government. When the authority for a beach monitoring and advisory program differs from the state water quality standards program, EPA encourages coordination of these programs to ensure the greatest efficiency and consistency in monitoring and data collection..

Beach monitoring contrasts with the use of monitoring data for making a determination that a waterbody is not attaining water quality standards as specified under CWA §303(d). In this case, states will usually consider data collected over a longer period of time.

3.1 What are the BEACH Act amendments and how do they apply to waters designated for recreation under a state or tribe's water quality standards?

On October 10, 2000, the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) was passed, amending the Clean Water Act to provide for monitoring of coastal recreation waters and public notification when the applicable water quality standards are not met or are not expected to be met. As defined by the Act, coastal recreation waters are the marine, coastal estuaries, and Great Lakes waters. The amendments contain three significant provisions, summarized as follows:

1. The BEACH Act amended the CWA to include section 303(i), requiring states with coastal recreation waters to adopt new or revised water quality standards by April 10, 2004, for pathogens and pathogen indicators that are as protective as the criteria published by EPA under CWA section 304(a). The BEACH Act amendments further direct EPA to promulgate such standards for states that fail to do so. For those states that have not adopted water quality standards as protective as EPA's water quality criteria, EPA intends to publish an Advance Notice of Proposed Rulemaking identifying those states not adopting such criteria prior to its proposing federal water quality standards.

2. The BEACH Act amended the CWA to require EPA to study issues associated with pathogens and human health and, by October 10, 2005, to publish new or revised CWA section 304(a) criteria for pathogens and pathogen indicators based on these studies. See CWA §104(v). Within 3 years after EPA's publication of the new or revised section 304(a) criteria, states that have coastal recreation waters must then adopt new or revised water quality standards for all pathogens and pathogen indicators to which EPA's new or revised section 304(a) criteria apply.

3. The BEACH Act amended the CWA to include a new section, section 406, which authorizes EPA to award grants to states for the purpose of developing and implementing a program to monitor for pathogens and pathogen indicators in coastal recreation waters adjacent to beaches that are used by the public and to notify the public if water quality standards for pathogens and pathogen indicators are exceeded or likely to be exceeded.

To be eligible for the implementation grants, states must develop monitoring and notification programs that are consistent with performance criteria in EPA's *National Beach Guidance and Required Performance Criteria for Grants.* Development grants were made available to all eligible states in 2001, and will be made available again in 2002. The BEACH Act also requires EPA to perform monitoring and notification activities for waters in states that do not have a program consistent with EPA's performance criteria, using grants funds that would otherwise have been available to those states. For the full text of the BEACH Act, see Appendix A

3.2 How will EPA determine if a state's water quality standards are as protective as EPA's 1986 water quality criteria for bacteria?

EPA will consider a state's water quality standards to be as protective as its recommendations consistent with the requirements in CWA §303(i)(1)(A) applying to coastal and Great Lakes states if the state's criteria are (1.) based on an illness rate equal to or less than 14 illnesses per 1000; and (2.) uses a geometric mean and a single sample maximum;

EPA recommends states adopt both a geometric mean and single sample maximum for several reasons. Because the WQS forms the basis for several purposes under the Clean Water Act, adoption of both a geometric mean and a single sample maximum will give states the necessary components to best implement their adopted criteria for water quality-based effluent limits, determine whether a waterbody is attaining its water quality standards, and issue beach notifications and advisories.

EPA would not consider a single sample maximum adopted exceeding the value associated with the 95% confidence level value to be as protective as its recommendations. EPA would also consider such criteria protective of primary contact recreation uses for waters not covered under the BEACH Act.

In determining whether a state's water quality standards are as protective as EPA's 1986 water quality criteria for bacteria for BEACH Act purposes, it is useful to review the development and analyses supporting the criteria. This analysis also applies to situations outside the context of the BEACH Act in evaluating and adopting the appropriate criteria to protect primary contact recreation uses. Appendix C

In terms of risk management, selecting a lower confidence level (e.g., 75%) for comparison to single measurements will result in a more conservative estimate of whether the measurement is associated with a given geometric mean value. In the case of beach advisories, this more conservative approach may be warranted. EPA considers the range of the 75% to 95% confidence levels to represent an appropriate balance between "false positives" and "false negatives" for determining attainment of a geometric mean associated with a given illness rate.

Both the selection of a target illness rate within a certain range and the choice of a specific single sample maximum value within this range is a risk management decision at the discretion of the state. Another important consideration is the consequence of the decision (e.g., more illnesses versus the loss of recreational use resulting from a beach advisory or closure). The table of single sample maximum values presented in the 1986 criteria document includes qualitative descriptors of beach usage associated with different confidence levels. This represents one approach to risk management, one that reflects a strong bias toward avoiding the potential for greater numbers of illnesses at more heavily used recreational waters.

As described in the *Ambient Water Quality Criteria for Bacteria–1986*, a state may re-calculate a standard deviation specific to the waterbody and subsequently adopt into water quality standards single sample maximum values specific to the observed distribution of criteria. For any state choosing this option, data used should be sufficient in number and representative of the waterbody.

EPA understands that the authority for administering beach programs varies among states and tribes and may rest with state, tribal, county, or municipal government. When the governmental body with the responsibility and authority for a beach monitoring and advisory program differs from the state water quality standards program, EPA encourages coordination of these programs to ensure the greatest efficiency and consistency in monitoring and data collection. Additional information on the use of EPA's recommended criteria for bacteria in beach monitoring and notification programs will be found in *EPA's National Beach Guidance and Required Performance Criteria for Grants*, U.S. Environmental Protection Agency, Washington, DC. EPA-823- B-02-004

4. Appropriate Approaches for Managing Risk in Recreational Waters

States have adopted primary contact recreation uses and bacteriological criteria for the majority of waterbodies in the United States. Pursuant to the federal regulations, primary contact recreation uses must be adopted for waterbodies unless such uses are shown not to be attainable. Further, primary contact recreation uses must be adopted wherever necessary to protect such uses downstream. See 40 CFR 131.10(b), 40 CFR 131.10(j).

As highlighted in section 2, states may help assure protection of recreational waters through frequent monitoring of known recreation areas to establish a more complete database upon which to determine if the waterbody is attaining the water quality criteria; assuring that where mixing zones for bacteria are authorized, they do not impinge upon known primary contact recreation areas; and conducting sanitary surveys when higher than normal levels of bacteria are measured.

Sanitary surveys are an important element of protecting recreational waters and have long been used as a means to identify potential sources of contamination. A sanitary survey examines a watershed to determine if unauthorized discharges are occurring from sources such as failed septic tank leach fields or cesspools, sewage leakage from broken pipes, sanitary sewer overflows from hydraulically overloaded sewers, or overflows from storm sewers that may contain illegal sanitary sewer connections. The survey uses available public health and public works departments' records to identify where such septic tanks and sewer lines exist so that observations are focused in the right places. A sanitary survey might also use dyes or other tracers in both dry and wet weather to test for discharges occurring from septic tanks and sewers. EPA recommends that sanitary surveys identify other possible sources, including confined animal areas, wildlife watering points, and recreational spots, such as dog running/walking areas, since these are also sources of fecal pollution. Additional guidance for conducting sanitary surveys may be found from several sources: *The National Beach Guidance and Required Performance Criteria for Grants* contains a section discussing the use of sanitary surveys in recreational waters and contains a summarization of recent publications on the subject. Additional resources include the Guidance Manual for Conducting Sanitary Surveys of Public Water System (USEPA, 1999), the National Shellfish Sanitation Program Model Ordinance (NSSP, 1999), and California's Guidance for Saltwater Beaches (draft) and Guidance for Freshwater Beaches (draft) (CA DHS, 2000a; CA DHS, 2000b).

4.1 Where should the primary contact recreation use apply?

States should designate primary contact recreation and adopt water quality criteria to support that use. **States should assure that primary contact recreation uses are designated for waterbodies where people are likely to engage in activities that could result in ingestion of water or immersion.** These activities logically include swimming, water skiing, kayaking, and any other activity where contact and immersion in the water is likely. However, states should also be aware that although conditions may make it unlikely that these activities would occur, EPA believes that people, particularly children, may swim or make other use of the waterbody such that ingestion may occur. **Children are more likely to engage in activities where ingestion of water is likely, even in waterbodies where ingestion would not be likely for adults.** Children splash and swim in shallow waters that may otherwise be considered too shallow for full body immersion. Other populations, such as kayakers or surfers, may actually seek out high flow or unsafe waters in which to recreate.

4.1.1 What water quality criteria for bacteria should states adopt to protect waters designated for primary contact recreation?

In adopting criteria to protect primary contact recreation waters, EPA recommends states use enterococci and/or *E. coli* criteria with a specified illness rate no greater than 14 illnesses per 1000 swimmers for fresh waters. These recommendations are contained in Appendix C.

States should adopt both a geometric mean and a single sample maximum using the values or equations described in Appendix C to calculate the appropriate geometric mean and single sample maximum values. EPA believes that the objective of protecting primary contact recreation waters is best achieved through this approach. See 3.2. For waters that are known to be heavily-used swimming areas and where necessary to protect downstream primary contact recreation uses, states should consider using more conservative approaches, such as adopting criteria based on lower illness rates (e.g., 8 illnesses per 1000 swimmers for fresh waters) or a more conservative single sample maximum (e.g., single sample maximum values based on the 75% confidence level). For recommendations on refining recreation uses for waters where primary contact recreation is not attainable, see section 4.4.

States that opt to protect primary contact recreation waters with criteria associated with illness rates within these ranges should recognize that this is a risk management decision by the state similar to the selection of alternate risk levels when adopting human health criteria for carcinogens, and thus would not require a use attainability analysis as described by the federal regulations at 40 CFR 131.10. Exercising such discretion should assure, however, that downstream uses, including downstream uses across state boundaries, are protected. Further, like any other addition or revision to a state water quality standards, any subsequent change resulting from these risk management decisions are subject to the public participation requirements at 40 CFR 131.20(b). In utilizing this risk management discretion, states may wish to establish more than one category of primary contact recreation use.

4.1.2 When is it appropriate to adopt seasonal recreational uses?

A seasonal recreation use may be appropriate in those states where ambient air and water temperatures cool substantially during the winter months. For example, in many northern areas, primary contact recreation is possible only a few months out of the year. **Several states have adopted, and EPA has approved, primary contact recreation uses and the associated microbiological water quality criteria only for those months when primary contact recreation occurs and have relied on less stringent secondary contact recreation water quality criteria to protect for incidental exposure in the "non-swimming" season.**

The federal regulation allows for seasonal uses, provided the criteria adopted to protect such uses do not preclude the attainment and maintenance of a more protective use in another season. See 40 CFR 131.10(f). EPA feels this is an appropriate approach where treatment of discharges sufficient to meet the primary contact recreation use would result in the release of residual chlorine in the effluent. Total residual chlorine in effluents discharging to surface waters can react with organic compounds to produce disinfection by-products such as trihalomethanes. In addition, are of particular concern in waterbodies used for drinking water and areas where aquatic life may be adversely impacted. Thus, in some cases states have adopted seasonal uses to allow for the reduction or suspension of effluent chlorination during the colder months and, consequently, to reduce risk. The rationale provided by states to EPA to support a change in water quality standards resulting in adoption of a seasonal recreation use for a waterbody need not be burdensome. EPA's regulations do

not require a formal use attainability analysis for the adoption of seasonal recreation uses. Generally, for a state contemplating such a revision to its recreational water quality standards, EPA would expect that the state provide information on why the particular season is being chosen. This information may include information relating to the times of year when the ambient air and water temperatures support primary contact recreation, activities in and use (or lack thereof) of the waterbody during the proposed non-recreation months, and other relevant information.

4.2 What is EPA's policy regarding high levels of indicator organisms from animal sources?

In the 1994 *Water Quality Standards Handbook*, EPA established a policy that states may apply water quality criteria for bacteria to waterbodies designated for recreation with the rebuttable presumption that the indicators show the presence of human fecal contamination. Rebuttal of this presumption, however, must be based on a sanitary survey that demonstrates a lack of contamination from human sources.

EPA no longer believes that the position taken in the 1994 Water Quality Standards Handbook is supported by the available scientific data. States may no longer use broad exemptions from the bacteriological criteria for waters designated for primary contact recreation based on the presumption that high levels of bacteria resulting from non-human fecal contamination present no risk to human health.

Recent evidence indicates that warm-blooded animals other than humans may be responsible for transmitting pathogens capable of causing illness in humans. Examples include outbreaks of enterohemorrhagic *E. coli* O157:H7, *Salmonella, Giardia*, and *Cryptosporidium*, all of which are frequently of animal origin. Consequently, due to the potential for animal sources to contribute human pathogens to surface waters, EPA is changing its 1994 policy through this guidance to recommend that states apply their water quality criteria for bacteria to all waterbodies designated for primary contact recreation in order to ensure protection of human health from gastrointestinal illness.

While EPA believes that non-human sources are capable of transmitting pathogens that can cause the specific kinds of gastrointestinal illness identified in EPA's original epidemiological studies, the specific risk from these sources has not been fully determined.

Unless and until the time that the absence of a relationship between non-human sources of fecal contamination and human illness rates is established, EPA recommends that states apply their water quality criteria for bacteria to all waterbodies designated with primary contact recreation in order to ensure protection of human health from gastrointestinal illness.

While EPA believes a change in this policy is necessary to ensure protection of human health, EPA acknowledges such a change may present states with difficulties, such as the routine exceedance of the ambient water quality criterion due to natural sources of pollution. Changes to the designated use may be the most appropriate way to address these situations. Examples of natural (and potentially uncontrollable) sources are resident wildlife populations, migrating waterfowl, wildlife refuges, or lakes frequented by waterfowl.. Section 4.4.2 discusses the process a state would follow to refine recreational uses where contamination from natural sources is significant.

4.4 What options exist for adopting subcategories of recreation uses?

States may adopt subcategories of recreation uses. More choices in subcategories of recreational uses will allow states to better tailor the level of protection to the waterbody where it is

most needed, while maintaining some protection for unanticipated recreation in waters where primary contact recreation is unattainable. In determining the appropriate recreational use for a waterbody, states should consider the fact that in certain circumstances people will use whatever waterbodies are available for recreation, regardless of the physical conditions, and that adopting a recreational use subcategory may necessitate a concurrent plan or actions by the state to communicate to the public the potential risks or hazards associated with recreating in certain waterbodies. In adopting recreational subcategories with criteria less stringent than that associated with primary contact recreation, some analysis will be required. While most recreational waters are designated for primary contact recreation to protect people engaged in water immersion activities, there are some waters where, if it can be shown that recreation is not an existing use pursuant to 40 CFR 131.10(h)(1), recreation uses may be removed altogether. **States must justify a change to the primary contact recreation use for a waterbody through a use attainability analysis**. See 40 CFR 131.10(g). **Subject to the provisions of 40 CFR 131.10, recreation uses other than primary contact recreation may be applicable to waters where, for example, human caused conditions combined with wet weather events cannot be remedied, or where meeting the primary contact recreation use at all times would result in substantial and widespread social and economic impact. Where states have adopted uses less than primary contact recreation, federal regulations require a re-examination every three years to determine if any new information has become available to support the designation of a more protective recreation use.** See 40 CFR 131.20.

[7] One of the six conditions listed under 40 CFR 131.10(g) must be met in order to remove a designated use which is not an existing use, or to establish sub-categories of a use:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating **State** water conservation requirements to enable uses to be met; or

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to the natural features of the waterbody, such as the lack of a proper

substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

4.4.1 When is it appropriate to modify primary contact recreation uses to reflect high flow situations?

An intermittent recreation use may be appropriate when the water quality criteria associated with primary contact recreation are not attainable for all wet weather events. Meeting the water quality criteria associated with the primary contact recreation use may be suspended during defined

periods of time, usually after a specified hydrologic or climatic event. EPA intends this intermittent primary contact recreation use to be adopted for waterbodies in a limited number of circumstances, contingent upon a state demonstrating that the primary contact recreation use is not an existing use, is not attainable through effluent limitations under CWA §301(b)(1)(A) and (B) and §306 or through cost effective and reasonable best management practices, and meets one of the six reasons listed under 40 CFR 131.10(g).[7]

The length of time the water quality criteria (and, thus, the recreation uses) should be suspended during these events should be determined on a waterbody-by waterbody basis, taking into account the proximity of outfalls to sensitive areas, the amount of rainfall, time of year, etc., and should not allow for any lowering of existing water quality.

EPA anticipates that the use of high flow cutoffs will be primarily applicable to flowing waterbodies and still waters impacted by flowing waterbodies, where high flows are accompanied by high levels of indicator bacteria that cannot be controlled without substantial and widespread social and economic impact. When considering whether a high flow cutoff may be appropriate for a particular waterbody, states should evaluate the effects of the wet weather events on the recreation use. For example, in some waterbodies, high flows routinely provide an attractive recreation environment (e.g., for kayakers), making such waters ineligible for a high flow cutoff because this type use of a waterbody constitutes an existing use, which cannot be removed. See 40 CFR 131.10(h)(1).

Adoption of a high flow cutoff should be based on rigorous scientific assessment and needs to reflect public input. If the waterbody is impacted by combined sewer overflows, the supporting analysis for any water quality standards revision should be consistent with, or reflected in, the Long Term Control Plan (LTCP). Additionally, such a cutoff should apply on a case-by-case basis (rather than state-wide, for example), should be tailored to the waterbody (rivers, as distinct from lakes), and should set the cutoff at a point where it only applies under certain limited conditions. For flowing waters, one approach is to specify the flow conditions when an exceedance may be allowed. Alternately, for either flowing or still waters, a state may specify a certain number of events per year where the bacteriological criteria may be exceeded. If a **state** adopts a high flow cutoff, it should address several questions:

- Will other uses of the waterbody continue to be protected even when the high flow cutoff is triggered?
- What is the resulting velocity during the high flow events when the designated use would not be protected?
- Would the velocity during these events preclude all recreational uses (including kayaking) that typically occur during high velocity flows?
- Do the high flows have a minimal effect on the velocity of the flow, posing little or no danger to persons using the waters for recreation?
- For how many days would the cutoff apply and how was the length of time determined?
- Will the state adopt the cutoff as a discharger-specific variance, or create recreational subcategories correlating to the cutoff?
- Has a use attainability analysis shown that additional controls within the water watershed would result in substantial and widespread social and economic impact?
- What effect would the high flow cutoff have on implementing controls for all sources of bacterial contamination to the waterbody (e.g., CSOs, storm water, leaking septic systems, feed lots, row crops, etc.)?

States implementing such a high flow cutoff should include scientifically valid methodologies for maintaining and protecting the primary contact recreational uses when normal flow returns and for protecting downstream uses. While EPA has not developed a national policy on a high flow/velocity cutoff for bacteria and recreational uses, EPA envisions a methodology that **states** could apply on a site-specific basis using the waterbody channel and landscape characteristics. **States** could also create a subcategory of the recreational uses to which the cutoff would apply. **Since use of a high**

flow/velocity cutoff reduces the level of protection for the waterbody, a use attainability analysis would be required for each waterbody to which the high flow/velocity cutoff applies. It would be particularly important to demonstrate that a community could not afford a higher level of control (or, for example, additional storm water or agricultural best management practices) without substantial and widespread social and economic impact. As with other changes in designated uses, the public must have an opportunity to comment on the proposed revision to the water quality standard before a **state** adopts and submits it to EPA for approval or disapproval under CWA §303(c). For **states** using this approach, EPA encourages the development of a plan to communicate to the public the conditions under which recreation should not occur. For waterbodies that are known to be beaches or heavily used recreation areas, EPA encourages caution in adopting intermittent suspensions of the primary contact recreation use. If the **state** finds after public comment that such a revision to water quality standards for a beach area is supported, EPA encourages beach managers to issue advisories during the cutoff conditions unless monitoring data are collected indicating it is safe to recreate. EPA feels this is the most appropriate implementation measure for those waters heavily used for recreation since the adoption of such a cutoff presumes that, under the conditions specified by the state , the bacteriological criteria will be exceeded and, thus, may present a hazard to swimmers. Further guidance on refining water quality standards specifically for combined sewer overflow receiving waterbodies is contained in the *Coordinating CSO Long-Term Planning With Water Quality Standards Reviews* (USEPA, 2001).

4.5 What is EPA's policy regarding secondary contact recreation uses?

While recreational waters have been designated by states for primary contact recreation to protect people engaged in recreational activities, there are some waters where a secondary contact recreation use with less stringent water quality criterion may be more appropriate. Activities that constitute secondary contact recreation include those in which contact and immersion with the water is unlikely. States may justify the adoption of a secondary contact recreation use through a use attainability analysis. Subject to the provisions of 40 CFR 131.10, a secondary contact recreation use may be applicable to waters that are, for example, impacted by human caused conditions that cannot be remedied, or where meeting the criteria associated with the primary contact recreation use would result in substantial and widespread social and economic impact.

4.5.1. When is it appropriate to designate a secondary recreation use?

EPA considers waters designated for primary contact recreation and waters designated for secondary contact recreation with bacteriological water quality criteria sufficient to support primary contact recreation to be consistent with the CWA §101(a) goal uses. **States may designate other recreation uses after demonstrating that primary contact recreation is not an existing use and the water quality necessary to support the use is not attainable based on chemical, physical, and biological analyses, as well as economic considerations.** Any adoption of a secondary contact recreation use with less stringent water quality criteria than required for primary contact recreation or the removal of recreation uses requires the state to submit appropriate justification for the change in designated use to EPA for review and approval. Also, see section 4.5.3 for EPA's recommended water quality criteria for secondary contact recreation uses. Where a primary contact recreation use and the water quality necessary to support the use is not attainable and primary contact recreation is not an existing use, the **state** should evaluate whether the other subcategories of recreation described in the previous sections are appropriate. If not, a secondary contact recreation use with less stringent water quality criteria may be appropriate. An example would be a situation where flowing or pooled water is not present within a waterbody during the months when primary contact recreation would otherwise take place

and the waterbody is not in close proximity to residential areas, thereby indicating that primary contact recreation is not likely to be an existing use. If it can also be demonstrated that natural, ephemeral, intermittent, or low flow conditions or water levels prevent attainment of the primary contact recreation use, a secondary contact recreation use may be appropriate. Another example would be a discharger that may not be able to meet limits necessary to protect the primary contact recreation use without causing substantial and widespread social and economic impact, but can meet limits that would assure protection of a secondary contact recreation use. These demonstrations would fulfill the requirements of and address one of the six conditions contained in 40 CFR 131.10(g) justifying the removal of a designated use. In addition, as discussed in section 4.4.2, designating a secondary contact recreation use may also be appropriate where primary contact recreation is not an existing use and high levels of natural and uncontrollable fecal pollution exist.

4.5.2 What information should be contained in a use attainability analysis to remove a primary contact recreation use?

States should consult EPA guidance (USEPA, 1995; USEPA, 1994) for general guidelines on conducting use attainability analyses for recreation uses. The likely components of a use attainability analysis for recreation uses may include:

physical analyses considering the actual use, public access to the waterbody, facilities promoting the use of recreation, proximity to residential areas, safety considerations, and substrate, depth, width, etc. of a waterbody;

chemical analyses of existing water quality; potential for water quality improvements including an assessment of nutrients and bacteriological contaminants; and

economic/affordability analyses.

EPA has previously stated that, "**Physical factors, which are important in determining attainability of aquatic life uses, may not be used as the basis for not designating a recreational use consistent with the CWA section 101(a)(2) goal" (USEPA, 1994)**. EPA continues to believe that physical factors alone would not be sufficient justification for removing or failing to designate a primary contact recreation use. EPA's suggested approach to the recreational use issue is for states to look at a suite of factors such as whether the waterbody is actually being used for primary contact recreation, existing water quality, water quality potential, access, recreational facilities, location, safety considerations, and physical conditions of the waterbody in making any use attainability decision. **Any one of these factors, alone, may not be sufficient to conclude that designation of the use is not warranted.**

EPA continues to believe that downgrading or removing recreational uses due only to physical conditions is inappropriate when it is *otherwise feasible to meet water quality standards.* However, when considered with other data collected for a use attainability analysis, there are a few instances where physical considerations may play an important role in informing a state 's decision to refine a recreation use and, in particular, in determining whether or not primary contact recreation is an existing use. This may include a waterbody where access is prevented by fencing or in an urban waterbody that also serves as a shipping port or has close proximity to shipping lanes. It may also include waterbodies where primary contact recreation is not an existing use, it can be demonstrated that flowing or pooled water is not present during the months when recreation would otherwise take place, and that the waterbody is not in close proximity to residential areas. In instances such as these,

the physical attributes help to ensure primary recreation does not and will not occur in these waterbodies.

EPA understands that substantial and widespread social and economic impacts are often determining factors in assessing whether or not the primary contact recreation use and water quality to support the use can be met. EPA has published guidance to assist **states** in considering economic impacts when adopting water quality standards (USEPA, 1995). The cost of placing additional control measures on sources of fecal contamination are often cited as the reason a water cannot attain the primary contact recreation use and the associated water quality criteria in all waters at all times. In the use attainability analysis process, the federal regulation at 40 CFR 131.10(g) lists the factors that may be used to demonstrate that a primary contact recreation use cannot be met; these factors include substantial and widespread social and economic impact, and natural conditions. **Water quality criteria are derived to address the effects of pollution concentrations on the environment and human health.** As such, **water quality criteria do not reflect consideration of economic impacts or the technological feasibility of meeting the ambient criterion concentration in the waterbodies, while under the federal regulation, the setting of designated uses (and the associated protective criteria) may take into account social and economic considerations.** See 40 CFR 131.10(g).

4.5.3 What water quality criteria should be applied to waters designated for secondary contact recreation?

For waterbodies where a state demonstrates through a use attainability analysis that removing a primary contact recreation use is justified, adoption of a recreational use and water quality criteria to protect secondary contact activities may be appropriate. Secondary contact activities as those activities where most participants would have very little direct contact with the water and where ingestion of water is unlikely. Secondary contact activities may include wading, canoeing, motor boating, fishing, etc. Many states have adopted secondary contact recreation uses for waterbodies. States with bacteriological water quality criteria based on fecal coliforms have generally adopted a secondary contact water quality criterion of 1000 cfu/100ml geometric mean, which is five times the geometric mean value used by many states to protect primary contact recreation. This water quality criterion has been applied to secondary contact uses and to seasonal recreation uses during the months of the year not associated with primary recreation. The *Ambient Water Quality Criteria for Bacteria*– 1986 recommending *E. coli* and enterococci as indicators did not recommend water quality criteria for recreation uses other than primary contact recreation. States have cited this as one reason why they have not adopted EPA's recommended water quality criteria.

EPA explored the feasibility of scientifically deriving criteria for secondary contact waters and found it infeasible for several reasons. Secondary contact recreation activities generally do not involve immersion in the water, unless it is incidental (e.g., slipping and falling into the water or water being inadvertently splashed in the face). While the main illness likely to be contracted during primary contact recreation is gastrointestinal illness, illnesses contracted from secondary contact recreation activities may just as likely be diseases and conditions affecting the eye, ear, skin, and upper respiratory tract. Because of the different exposure scenarios and the different exposure routes that are likely to occur under the two different types of uses, EPA is unable to derive a national criterion for secondary contact recreation based upon existing data. Despite the lack of information necessary to develop a risk-based secondary contact recreation criterion, EPA believes that waters designated for secondary contact recreation should also have in place an accompanying numeric

criterion. Protecting waters designated for secondary contact recreation with a numeric criterion for bacteria provides the basis for the development of effluent limitations and, where applicable, the implementation of best management practices. Such an approach also provides a mechanism to assure that downstream uses are protected and, where adopted as part of a seasonal recreation use, help to assure that the primary contact recreation use is not precluded during the recreation season. Adoption of a numeric criterion is a straightforward approach, transparent to the public, and consistent with historical practices. **States may wish to adopt a criterion five times that of the geometric mean component of the criterion adopted to protect primary contact recreation. In evaluating attainment with this criterion, states may wish to calculate geometric mean values based on samples taken over a 30-day period or on a seasonal or annual basis.** Another approach would be the adoption of numeric criterion as a maximum value protective of the secondary contact recreation use. EPA feels that this would also be an appropriate approach for states unable to collect sufficient monitoring data to calculate a geometric mean value. A narrative criterion along with implementation procedures may also form the basis for these measures.
States may also pursue an alternate approach to the protection of secondary contact recreation waters, and EPA will work with the state to ensure the approach is protective of the designated use and meets the above objectives.

4.5.4 Will EPA publish risk-based water quality criteria to protect for "secondary contact" uses?

EPA's Ambient Water Quality Criteria for Bacteria– 1986 are designed to protect the public from gastrointestinal illnesses associated with accidental ingestion of water. EPA has not developed any water quality criteria for secondary contact recreation to protect for other human health-based risks. Such additional water quality criteria could conceivably be based on the effects of dermal contact, such as rashes or other minor skin irritations or infections, and inhalation of water. As part of EPA's requirements under the BEACH Act amendments and commitments made in its Beach Action Plan, EPA intends to gather additional data and investigate the development of water quality criteria for transmission of organisms that cause skin, eye, ear, nose, respiratory illness, or throat infections. Some elements of such future water quality criteria may potentially be applicable to secondary contact uses.

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5.2.3 How do the anti-backsliding requirements apply to NPDES permits with effluent limits for bacteria?

Dischargers that previously had NPDES water quality-based effluent limits for fecal coliforms, and subsequently have water quality-based effluent limits based on a state or authorized 's newly adopted *E. coli* and/or enterococci criteria should also be aware of federal NPDES "anti-backsliding" provisions. If a state chooses to adopt *E. coli* or enterococci water quality criteria greater than, for fresh waters, an *E. coli* criterion of 126 cfu/100 ml or an enterococci criterion of 33 cfu/100 ml or, for marine waters, an enterococci criterion of 35 cfu/100 ml (generally occurring through the adoption of a subcategory of primary contact recreation use, other recreational subcategories, or secondary contact recreation use), the anti-backsliding elements of the CWA and federal regulations would apply. In these instances, the CWA and federal regulations would allow for backsliding in some circumstances as described below. EPA has consistently interpreted section 402(o)(1) of the CWA to allow relaxation of WQBELs if the requirements of CWA section 303(d)(4) are met. (While CWA §402(o)(2) allows for backsliding to occur when new information is present, revised water quality standards regulations do not constitute "new information" under this provision.)

Section 303(d)(4) has two parts: paragraph (A) applies to "non-attainment waters" and paragraph (B) applies to "attainment waters."

• Non-attainment water–Section 303(d)(4)(A) allows the establishment of less stringent WQBELs for waters identified under CWA §303(d)(1)(A) as not meeting applicable water quality standards (i.e., a "nonattainment water"), if two conditions are met. First, the existing WQBEL must be based on a total maximum daily load (TMDL) or other wasteload allocation. Second, relaxation of a WQBEL is only allowed if attainment of water quality standards will be assured.

• Attainment water–Section 303(d)(4)(B) applies to waters where the water quality equals or exceeds levels necessary to protect the designated use, or to otherwise meet applicable water quality standards (i.e., an "attainment water"). Under section 303(d)(4)(B), WQBELs may only be relaxed where the action is consistent with the state 's anti-degradation policy. It is important to note that these exceptions to the prohibition on anti-backsliding as a result of a change to water quality standards are only applicable to permits with water quality-based effluent limitations. They are not applicable to relax limitations based on technology-based treatment standards for the pollutants at issue

5.3 How should state and tribal water quality programs monitor and make attainment decisions for the water quality criteria for bacteria in recreational waters?

Monitoring protocols and assessment methodologies for recreational waters may differ depending upon the location of the waterbody, level of use, and program resources. The following sections describe appropriate approaches in the development and implementation of state monitoring and assessment programs for bacteria.

5.3.2 Once *E. coli* and/or enterococci have been adopted, how should recreational waters be assessed and attainment determined for waters where the bacteriological criteria apply?

Implementing water quality criteria for bacteria within a state's monitoring and listing program is a recurring topic within the ongoing dialogue EPA has with states and other stakeholders, particularly during the recent development of the *Consolidated Assessment and Listing Methodology* (USEPA, 2002a). The upcoming Version 1 of the Methodology will address water quality monitoring

strategies, data quality and data quantity needs, and data interpretation methodologies. This effort is focused on helping states improve the accuracy and completeness of their CWA §303(d) lists and §305(b) reports as well as streamlining these two reporting requirements. In addition, this document provides recommendations for the listing and assessment of waters designated for primary contact recreation and specifically refines previous recommendations on assessing attainment of the water quality criteria for bacteria.

States have questioned how the criteria should be interpreted when assessing waterbodies under CWA §305(b) and determining attainment under CWA §303(d). As discussed earlier, EPA recommends states adopt both a geometric mean and a single sample maximum value. For states that follow this approach, determining attainment would be based on an evaluation of the water quality data as they relate to both criteria components as specified in the state 's methodology.

Historically, states have used simple descriptive statistics to determine attainment consistent with these recommendations. Using this approach, the geometric mean of the total number of samples taken over a certain period of time is calculated and the results compared to the geometric mean component of the criterion. In addition, the monitoring data are compared to the single sample maximum value to assure that no sample has exceeded the single sample maximum value. Using simple descriptive statistics such as this, while acceptable to EPA, has several drawbacks. Most notably, use of this approach assumes that the entire population was representatively sampled, i.e., that the samples fully captured the range and variability of the ambient concentrations existing over the period of time in which the samples were taken.

States may also use what is known as inferential statistics (e.g., Students t-test, binomial and chi-square tests). The primary difference between the descriptive statistical approach described above and inferential statistics is how they handle uncertainty (i.e., decision error) and the likelihood that the sample data represent the population they are used to characterize. While descriptive statistics do not address uncertainty in the statistics used to describe the population of interest, inferential statistics assume a potential for error in using sample data to characterize the population and specifically address the likelihood that the sample data represent the population by setting targets for reasonable decision error. **States** that define acceptable decision error have taken on a greater responsibility for monitoring programs, because these states are systematically defining—and, it is hoped, committing the resources to collect sufficient samples to support the tests.

EPA prefers that, if sufficient data are collected, states and authorized s use inferential statistical models due to the ability of these models to provide the greatest certainty in making attainment decisions. Recommendations and discussions of the use of different statistical approaches will be provided in EPA's *Consolidated Assessment and Listing Methodology (*USEPA, 2002a) and are contained in EPA's *Guidance for Choosing a Sampling Design for Environmental Data Collection* (USEPA, 2000). Using statistical approaches enables the assessor to estimate, based on the samples taken and a specified confidence level, whether or not the criterion is being attained. In order for these approaches to provide reliable results, a certain amount of data must be collected as determined by data quality objectives, which in turn reflect individual state standards. Alternatively, states have employed other statistical approaches. For example, some states calculate confidence intervals, the upper limits of which are compared to the single sample maximum to determine compliance with that component of the criterion. Additional guidance on the use of alternate assessment approaches will be provided in the *Consolidated Assessment and Listing Guidance*.

If the state or tribal water quality standards define how the standards are to be interpreted, the state must follow its prescribed approach when assessing attainment. If the state's standards are silent on how to interpret data to make ambient attainment decisions, the state should describe its process. The state may either follow EPA recommendations or develop implementation procedures that are consistent with its water quality standards**. For example, if a state 's water quality criteria for bacteria consist of a geometric mean and a single sample maximum and specify that the geometric mean is to be calculated based on five samples taken over a thirty day period and that no sample may exceed the single sample maximum, the state's monitoring and assessment protocol should be consistent with these water quality standards provisions. In some circumstances, states may find that revisions need to be made to their water quality standards to clarify how the water quality standards will be interpreted for assessment and attainment determinations.**

Many states use information on bathing area restrictions and closures to determine attainment with recreation-based water quality standards. This information often comes from state, tribal, or local health departments and may be based on water quality monitoring, calibrated rainfall alert curves, or precautionary information. Before using this information on use restrictions and closures, it is important to document the basis for them. For example, the water quality agency may want to verify that the health department uses indicators and thresholds that are consistent with the state 's water quality standards. In general, water quality-based bathing closures or restrictions that are consistent with the state 's water quality standards and assessment methodology and are in effect during the reporting period should be used as an indicator of water quality standards attainment.

Regardless of the monitoring protocol used by a state , EPA recommends, at a minimum, that primary contact recreation waters be monitored throughout the swimming season, ideally on a weekly basis, to ensure human health is adequately protected, particularly waters that are beach areas. EPA has prepared additional guidance contained in the *National Beach Guidance and Required Performance Criteria for Grants* recommending monitoring approaches for identified beach areas, as well as recommendations on how to use the data in making beach closures and advisories. This document is available through EPA's Beach Watch web site at www.epa.gov/waterscience/beaches.

EPA recognizes that there may be some waterbodies that merit less frequent monitoring. These waterbodies may include those where public access is purposely restricted or limited by location and other waterbodies that are not likely to be used for primary contact recreation. Due to resources or other constraints, states may not be able to collect sufficient samples for these waterbodies to perform a robust statistical analysis or to collect five samples within a thirty-day period to perform the recommended arithmetic analysis. In addition, for waterbodies where infrequent sampling occurs, the few samples that are taken may have only been collected during the swimming season.

While EPA continues to encourage frequent monitoring of beaches and heavily-used recreation areas, for those waterbodies that are remote or, for other reasons, rarely used, EPA recommends states and authorized s develop monitoring protocols that describe how these waterbodies will be monitored. States should assure that any alternate monitoring protocols developed are consistent with its water quality standards. In some cases, states may wish to revise their water quality standards to clarify these approaches. Alternatively, states may choose to specify their monitoring procedures in their CWA §303(d) listing methodology. Regardless of where this information is contained, states should assure that their monitoring protocols and interpretation of the monitoring data are consistent with the expression of the applicable water quality standards.

Examples of types of monitoring approaches that may be applied to infrequently used recreational waters are described in Table 5-1

Table 5-1. Monitoring approaches for less frequently used primary contact recreation waters

Example #1 The sampling procedures for waters not identified as public or high use beaches specify that water quality data collected over a period of time longer than 30 days may be used to calculate geometric mean values. This may include calculation of seasonal geometric mean values or annual geometric mean values in addition to using the single sample maximum component.

Example #2 The sampling procedures for remote waters not identified as public or high use beaches specify the samples collected be compared to the single-sample maximum, serving as a trigger for collecting five samples within a 30-day period. If routine monitoring finds an exceedance of a single-sample maximum, then the **state** collects additional samples to calculate the geometric mean. The state then uses the geometric mean to make an attainment/ non-attainment decision (i.e., both the geometric mean and the single-sample maximum need to exceed the state or tribal standards for the waterbody to be identified as impaired under CWA §§305(b) and 303(d)). This approach differs from Example #4 in that the assessment decision is made only after additional data are collected.

Example #3 The sampling procedures for remote waters not designated as public beaches specify sampling to occur periodically. **On a rotating basin basis, sampling is conducted more intensively to confirm periodic sampling findings.**

Example #4 The sampling procedures for remote waters not identified as public or high use beaches are compared to the single-sample maximum to determine attainment status. If any of the samples collected exceeds the single sample maximum, the waterbody is determined to be impaired. This approach differs from Example #2 in that the assessment decision is made after comparison only with the single sample maximum. An exceedance results in a non-attainment decision by the state as opposed to triggering more monitoring.

When considering the spectrum of different types of waterbodies designated for recreation, approaches states take to monitor their waterbodies may vary with the uses assigned, since prioritization of monitoring resources may be directed more toward the heavily used recreation areas. For example, a state may choose an inferential statistical approach for the monitoring and evaluation of data for high use or identified bathing areas since more data are likely to be collected in these areas. Alternatively, states may choose an approach that relies on fewer data for other waterbodies that are primary contact recreation waters, but are not heavily used. Regardless of the approach used, **states** should specify which monitoring approaches they will be using. Additionally, states may find it useful to identify and provide to the public a list of recreation waters and the frequency with which they will be monitored.

5.5 What analytical methods should be used to quantify levels of *E. coli* and enterococci in ambient water and effluents?

The permit writer specifies the analytical methods to be used for monitoring in an NPDES permit. Typically, the methods specified are those cited in 40 CFR 136 in the standard conditions of the permit, unless other test procedures have been specified. In the case of the development of permits for *E. coli* and enterococci, while EPA is planning to publish final methods in 40 CFR 136 for *E. coli* or enterococci in the near future, methods do not yet exist in 40 CFR 136 for these constituents. The new methods will not appear in the Federal Register until Jan. 2003 at the soonest. Pursuant to 40 *CFR* 122.41(j)(4), permit writers have the authority to specify methods that are not contained in 40 CFR 136. In addition to commercially available test methods there are several EPA-approved methods permit writers may specify in permits, including the mE and the mEI agar methods for enterococci and the modified mTEC and mTEC agar methods for *E. coli*. This is what IDEM has been doing. At present, they can allow the use of Chromogenic Methods on a case-by-case basis.

5.6 How do the recommendations affect waters designated for drinking water supply? State adoption of EPA's bacteriological criteria recommendations into their water quality standards for the protection of drinking water supplies can provide a mechanism by which water quality may be maintained and protected and sources of fecal pollution controlled. Even though public water systems are required to remove microbial pathogens to safe levels for consumption, the adoption of EPA's recommended water quality criteria for bacteria to protect drinking water supplies provides an additional and critical measure of public health protection. EPA is contemplating the development of water quality criteria specifically targeted toward the protection of waters designated for drinking water supplies. This is one area identified in EPA's forthcoming *Microbial Waterborne Disease Strategy* that EPA intends to pursue.

References

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Water Quality Criteria for Bacteria for Fresh Recreational Waters

Enterococci Criteria

Illness Rate (per 1000)	Geometric Mean Density	Single Sample Maximum Allowable Density			
		Designated Beach Area 75% C.L.	Moderate Full Body Contact Recreation 82% C.L.	Lightly Used Full Body Contact 90% C.L.	Infrequently Used Full Body Contact 95% C.L.
8	**33**	**62**	**78**	**107**	**151**
9	**42**	**79**	**100**	**137**	**193**
10	**54**	**100**	**128**	**175**	**246**
11	**69**	**128**	**263**	**224**	**315**
12	**88**	**164**	**208**	**286**	**402**
13	**112**	**209**	**266**	**365**	**514**
14	**144**	**267**	**340**	**467**	**656**

E. coli Criteria

Illness Rate (per 1000)	Geometric Mean Density	Single Sample Maximum Allowable Density			
		Designated Beach Area 75% C.L.	Moderate Full Body Contact Recreation 82% C.L.	Lightly Used Full Body Contact 90% C.L.	Infrequently Used Full Body Contact 95% C.L.
8	**126**	235	487	576	669
9	**206**	300	381	524	736
10	**206**	383	487	669	941
11	**263**	490	622	855	1202
12	**336**	626	795	1092	1536
13	**429**	799	1016	1396	1962
14	**548**	1021	1298	1783	2507